



An Assessment of the State of the Lobster Fishery in the Kiunga Marine National Reserve (KMNR), Kenya

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Background

Key lobster spp

- ❑ *Panulirus ornatus* (Mwani), *P. vesicolor* (Kurabu), *P. longipes* (Mwilo), *P. homarus* (Springi), *P. penicillatus* (Kijiwe), *P. Dasypus*
- ❑ Main fishing method: Skin diving using scoop nets with octopus (kimia+pweza)



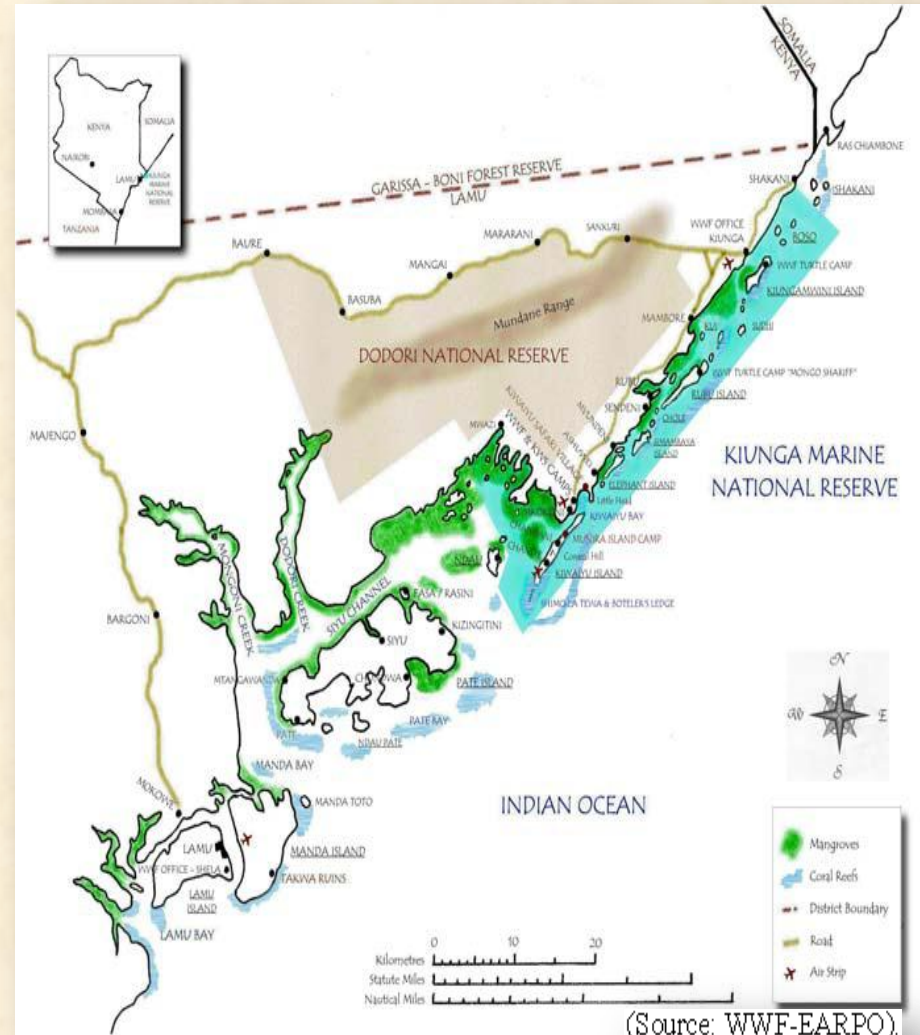
Objectives

❑ **Assess the status of the lobster fishery by:**

- 1) Determining the sustainability levels
- 2) Defining fishery indicators

Methods

- ❑ Used Fisheries “Yield” software package (Branch et al 2000) -Marine Resource Assessment Group (MRAG)
- ❑ Interview-based Survey (Sept-Nov 2009)....
To fill data gaps & get fishers’ views on lobster status & management options
- ❑ **Kiunga** Marine National Reserve (KMNR) is a significant marine biodiversity area
- ❑ **Kizingitini**, and **Kiwayu**...key lobster fishing areas



(Source: WWF-EARPO)

Methods

- ❑ Fisheries “Yield” software package (Branch et al 2000) was used.... Marine Resource Assessment Group (MRAG)
- ❑ Used data collected in 2000 (Fielding 2000)

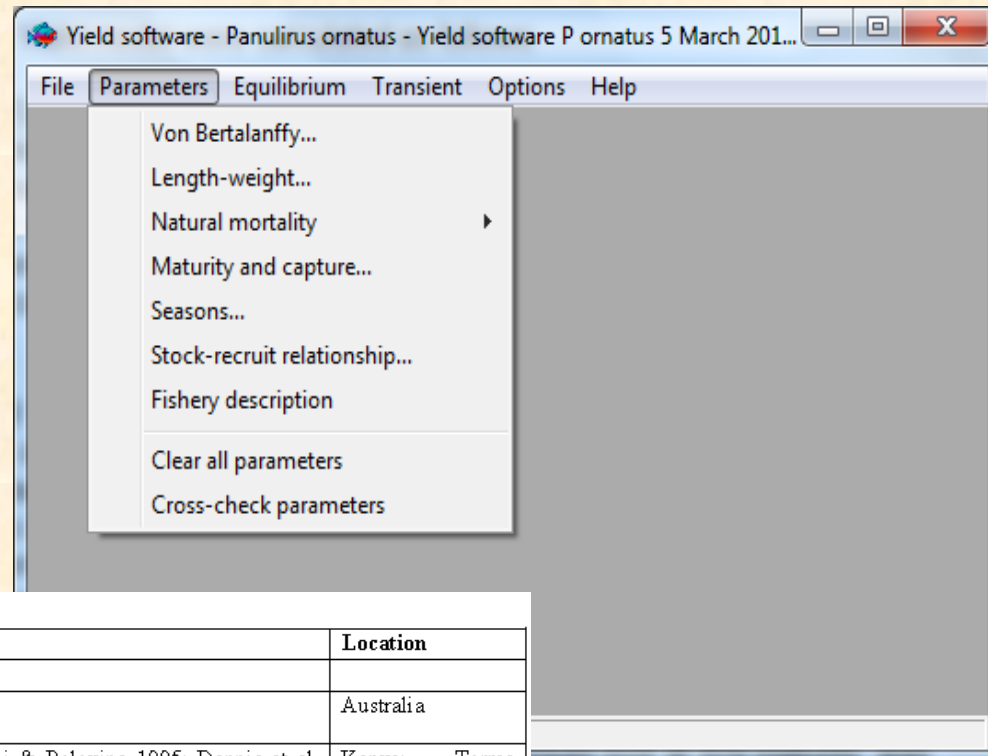


Table 1: Biological and fishery parameters for *Panulirus ornatus* used in the yield model

Parameter	Description	Source	Location
Distribution	Indo-Pacific	Richmond 2002	
von Bertalanffy growth parameter L_{∞} (Male)	177 mm CL	Pitcher et al. 1997	Australia
von Bertalanffy growth parameter K values range (Male)	0.11-0.58	Phillips et al. 1992; Okechi & Polovina 1995; Dennis et al. 1997; Pitcher et al. 1997; Skewes et al. 1997	Kenya; Torres Strait, Australia;
Length-Weight Parameters: Alpha (Length-Weight)	0.00135	Fielding and Everett 2000	Kiunga
Length-Weight Parameters: Beta (Length-Weight)	2.90	Fielding and Everett 2000	Kiunga, Kenya
Natural mortality (M): Females & Males	0.6-0.8	Fielding and Everett 2000	Kiunga
Age at Maturity	1.5 years	Pitcher et al. 1997	Australia
Spawning Season	March-April	Fielding & Everett 2000; this study	Lamu, Kenya
Fishing Season	January-December	The fishery is fished throughout. However, main fishing season is October-May. (this study; Fielding & Everett 2000; Kimani et al in prep.)	Lamu, Kenya
Stock Recruitment Relationship (SRR): Estimates of Biomass	SSB ₀ =74.7; Steepness (Beverton-Holt Steepness) = 0.5	this study adapted from Fielding & Everett 2000	Kiunga
Size at first Capture (Recruitment size)	40-70mm CL	Fielding & Everett 2000, Kimani et al in prep.	Kiunga
Size at 50% maturity	83.76 mm CL	Fielding and Everett 2000	Kiunga
Fishing mortality Males (F_m)	0.91-1.11	Fielding and Everett 2000	Kiunga

YPR reference points: MSY and SSB

- YPR analysis (Beverton and Holt 1957) gives strategies to avoid growth-overfishing (Quinn and Deriso, 1999), while SPR analysis gives strategies to avoid recruitment-overfishing (Sissenwine and Shepherd 1987).
- YPR analysis can be risky for predicting future yield because of year-to-year variation in recruitment but it is a useful tool for defining management measures.
- Fishing mortality (F) is the key parameter driving YPR analysis.
- YPR models are commonly employed to examine the question of optimising yield and preventing over-fishing through management controls on effort and length or age at first capture.

Results and Discussions

Yield per recruit (YPR) and Biomass-per-recruit

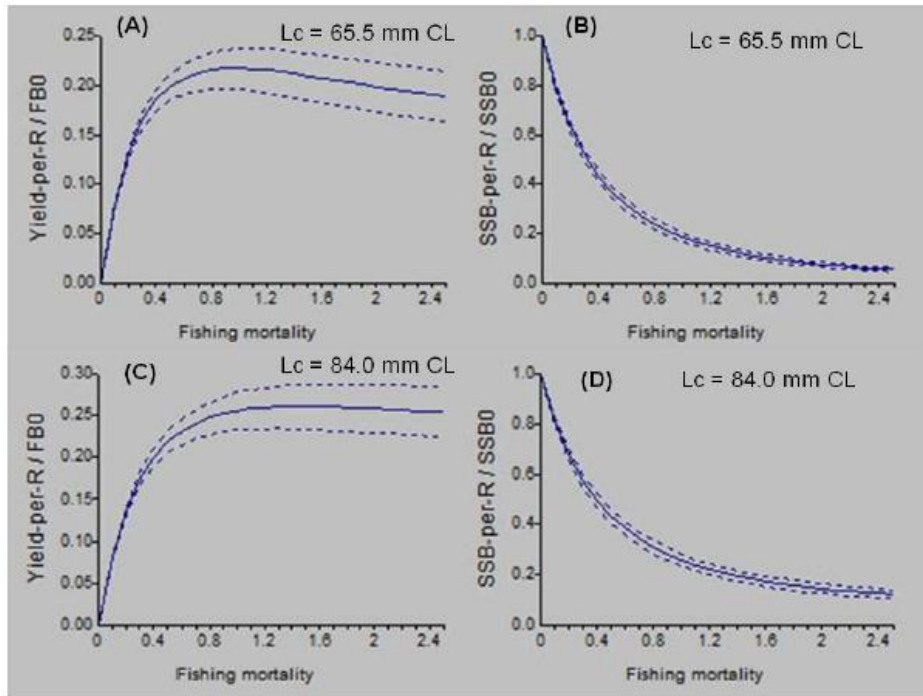


Figure 12. Yield per recruit and Biomass per recruit outputs from Yield model giving MSY and SSB for *P. ornatus* at different lengths at first capture (Lc).

Table 4: Estimated maximum fishing mortality rates (F) and spawning stock biomass (SSB) by varying lengths at first capture (Lc) from Yield per recruit and Biomass per recruit (as fraction of unexploited biomass) models.

Length (weight) at first Capture (Lc)	F	SSB-per-R/SSB0		
		2.5%	Median	97.5%
65.5 mm CL(250g)	1.0	16.6	18.6	20.3
70 mm CL (300g)	1.1	16.3	17.2	20.0
84.0mm CL (509g)	1.5	16.3	18.3	20.4

- MSY, expressed as the asymptote of the YPR model gives MSY at around $F = 1.0$ at $L_c=65.5$ mmCL, and 1.5 at $L_c =84.0$ mm CL
- Maintaining/increasing the current length of first capture from 65.5 mm CL to 84.0 mm CL would keep the SSB at ~18% of the virgin biomass

F=0.7 for all spp (2009)

F has declined since 2000 (F=1.1)

lobster fishery is not over fished if MSY is used as a target reference point.

YPR reference points: MSY and SSB

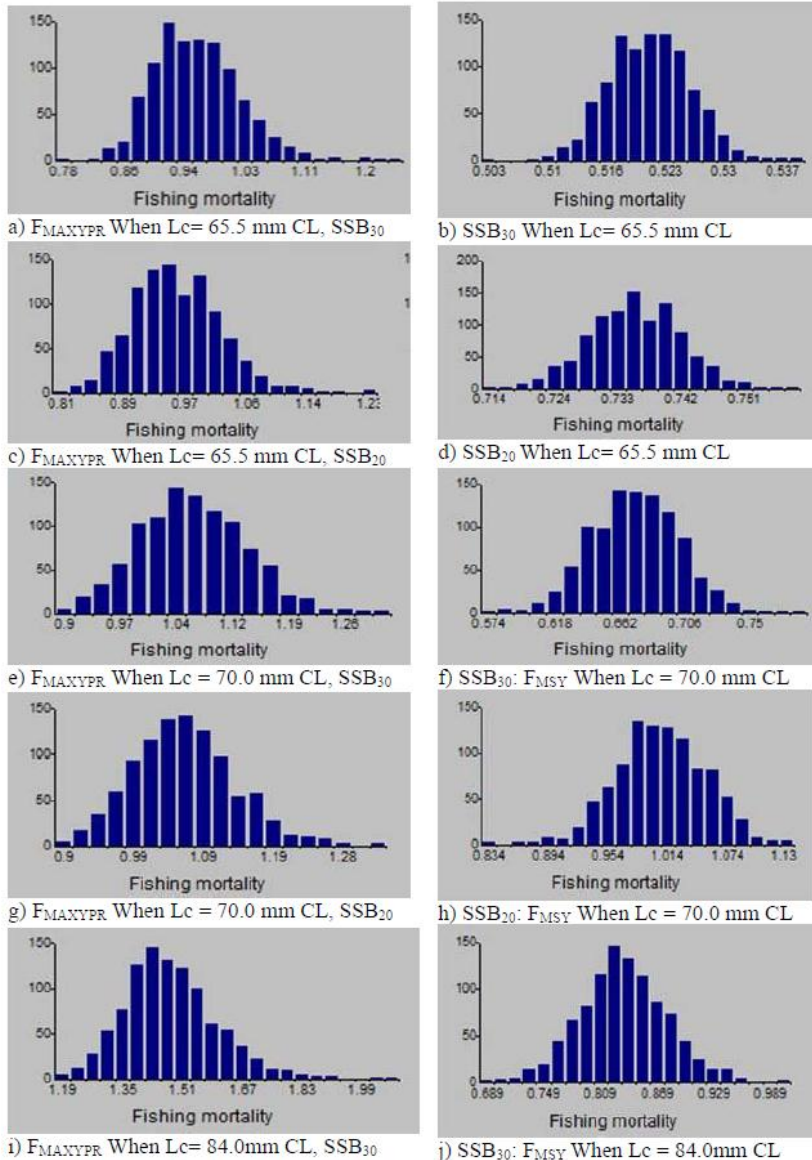


Figure 13: Examining the effects of changing length at first capture using YPR reference points. Optimal fishing mortality (F) for MSY (left hand plots), and optimal F for target spawning biomass (SSB_{30} and SSB_{20} , right hand plots), with fishing allowed throughout the year.

- using SSB_{30} as a reference point would require $F = 0.516-0.524$.
- Setting a lower SSB reference point (20%) would allow F to increase to 0.728-0.742

SSB a more precautionary reference point than MSY- it sets F lower, though it has been argued that using SSB as a target reference point can lead to under exploitation

These scenarios illustrate the ability to increase fishing effort if the minimum size is increased.

The effect of introducing a closed season between May-July

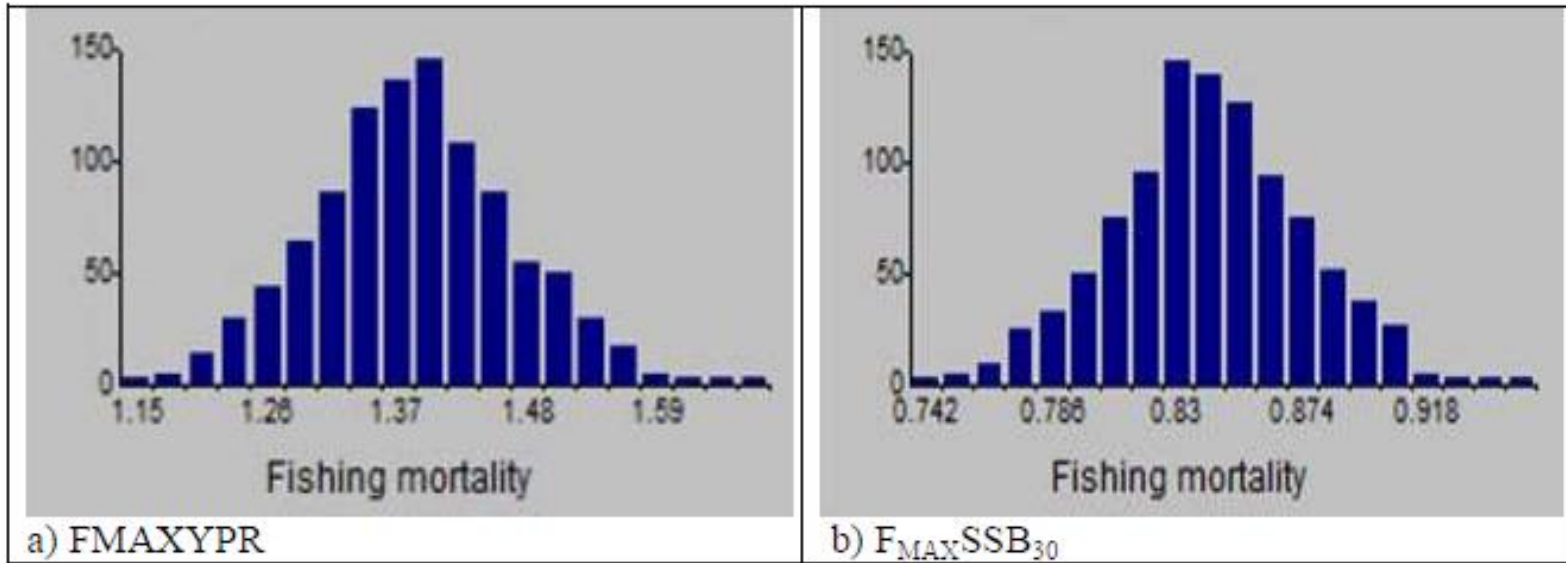


Figure 14: The effect of introducing a closed season between May-July with L_c at 70.0 mm CL, as proposed by stakeholders.

- Closed season May-July, at L_c 70.0 mmCL, SSB at 30% MSY as a reference point you get $F = 1.33-1.45$
- When using SSB as the reference point, $F = 0.86-0.89$

Socio-economic survey of the Lobster fishery



Table 1: Landing site information from lobster fishing villages and the number of fishers interviewed from the questionnaire survey.

Landing site/Village	Kiunga BMU*	Kiunga	Ishakani	Rubu	Mwambore	Kiwayu	Kizingitini
Fishers in the village	420	350	35	20	15	300	600
Licensed fishers	266	230	20	11	5	10	215
Lobster fishers	124	100	15	5	4	50	170
Licensed Lobster fishers	74	50	15	5	4	5	151
Lobster traders	6	6	0	0	0	2	7
Licensed Lobster traders	6	6	0	0	0	2	7
# Interviews		16 (17%)				10 (20%)	24 (14%)

*Kiunga Beach management unit (BMU) constitutes Kiunga, Ishakani and Rubu and Mwambore villages/landing sites. Numbers in brackets indicates the proportion of lobster fishers interviewed.

Lobster catches & Fishing Effort over the last 30 Years: Fishers' Perceptions

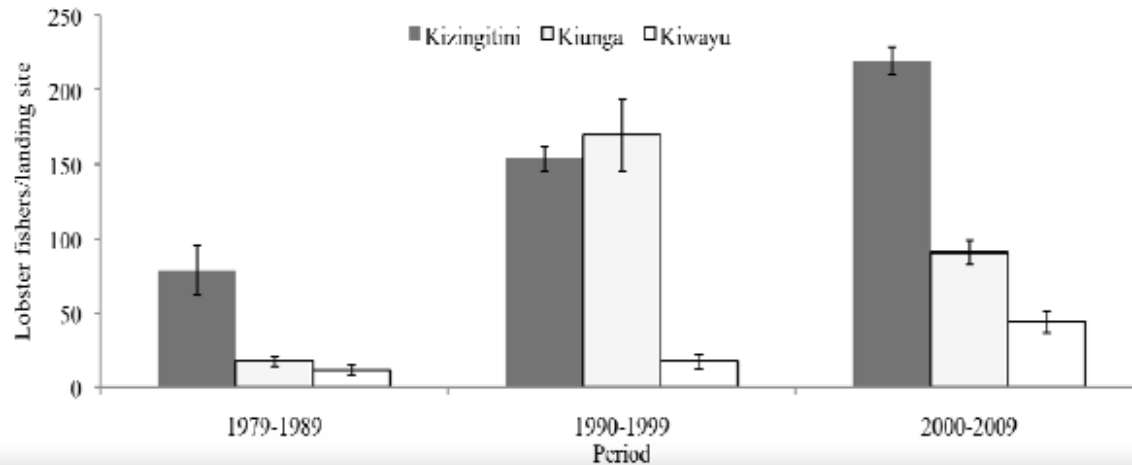


Figure 7: Fishing effort - variation in number of lobster fishers over the last 30 years in the three landing sites as perceived by fishers. Vertical bars are SE.

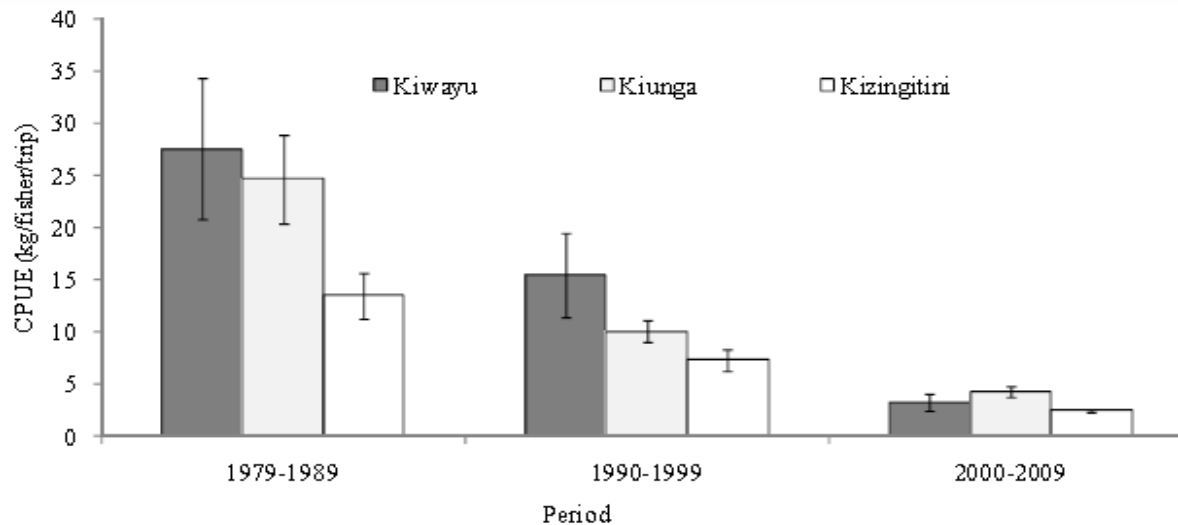


Figure 6: Fishers perceptions ($n=50$) of lobster catch rates over the last 30 years in the three villages. Vertical bars are standard error of the means (SE).

- ❑ Kizingitini is the main lobster fishing village
- ❑ Steep increase in lobster fishers ($R^2 = 0.79$)
- ❑ Kiwayu :fewer fishers but highest catch rates
- ❑ Declined catches over years to 15% of 1980s levels

Occurrences of Berried Females

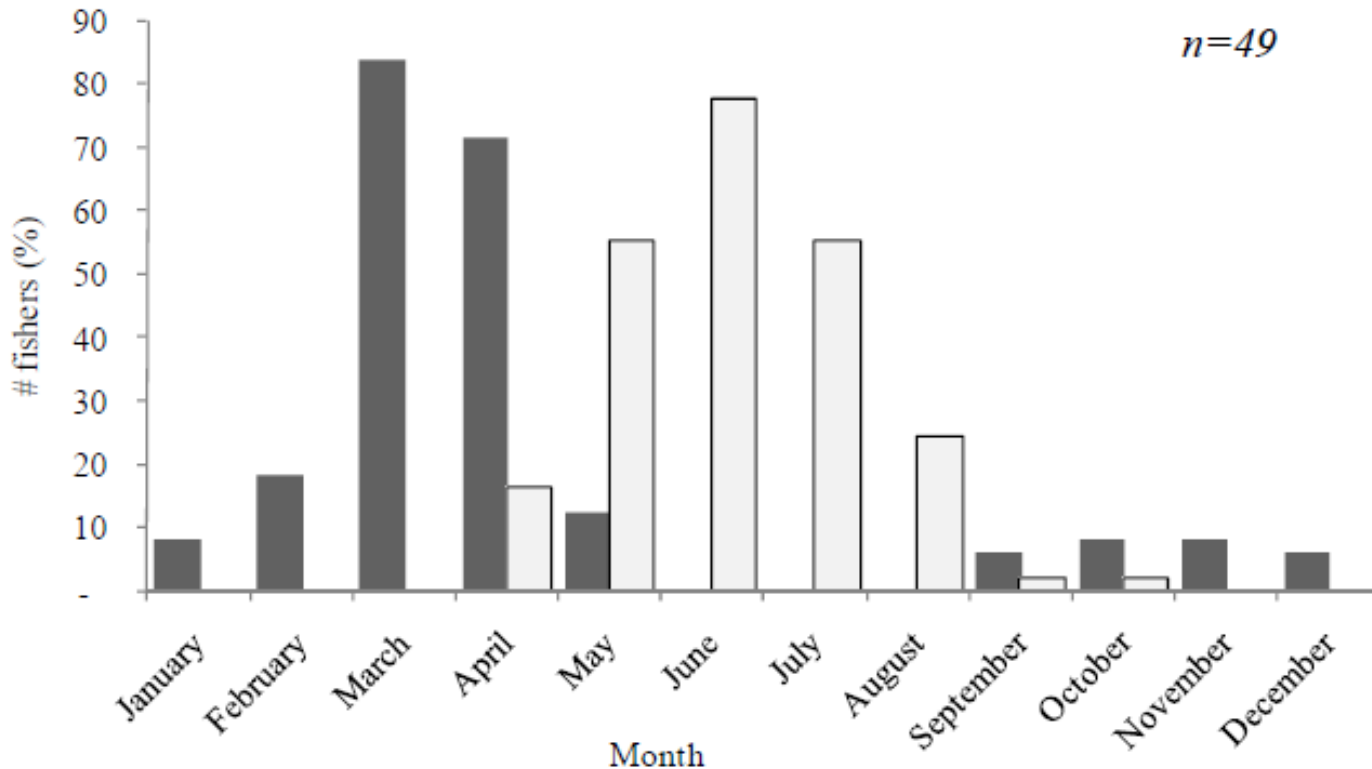
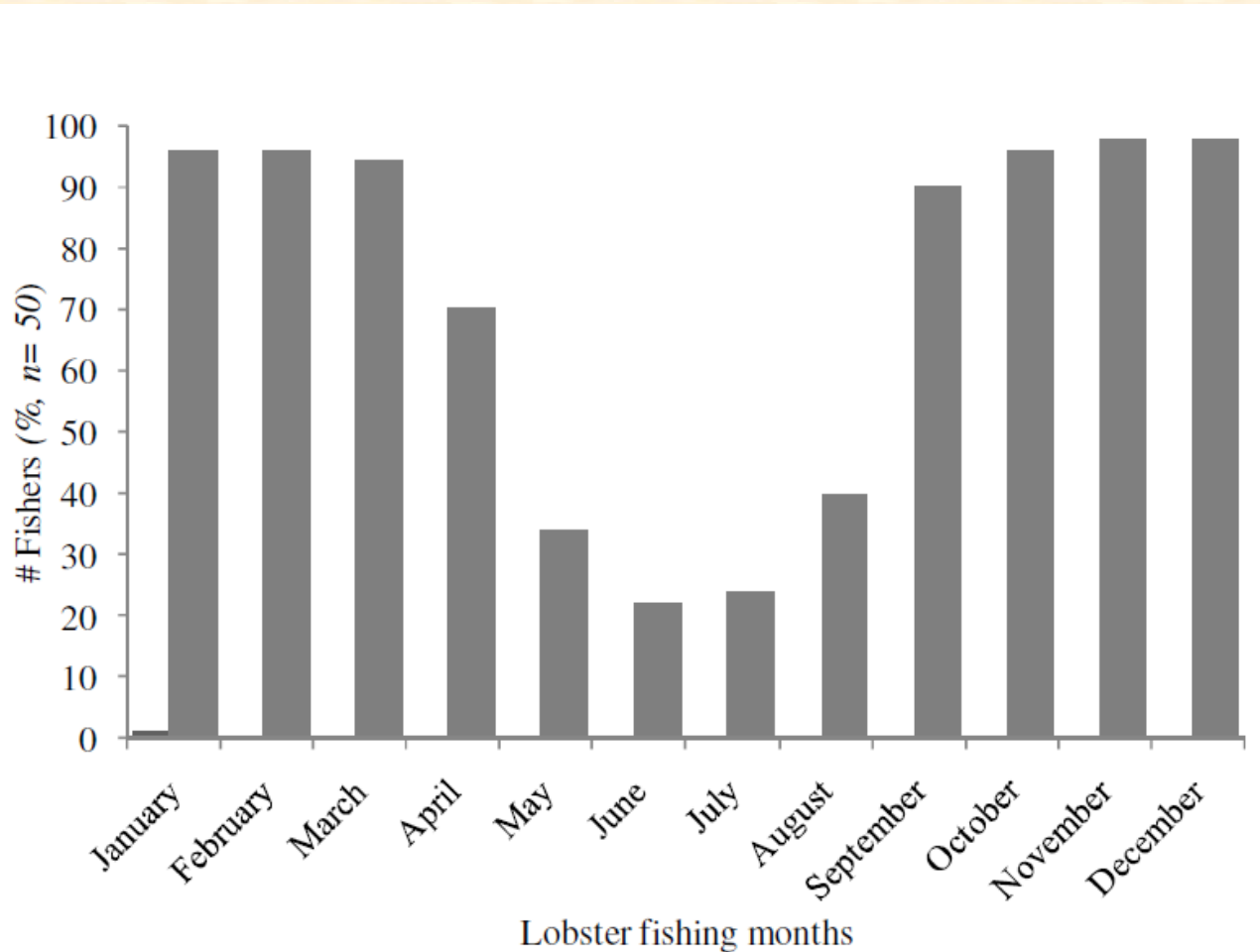


Figure 4: Fishers' description of periods when berried females and juvenile lobsters are mainly seen in the fishery. Dark bars = berried females; light bars = juveniles.



- Highest abundance of berried females during March-April period

Lobster Fishing Months



□ Lobster fishing season-Sept-April

Figure 7: Lobster fishing months from fisher interviews

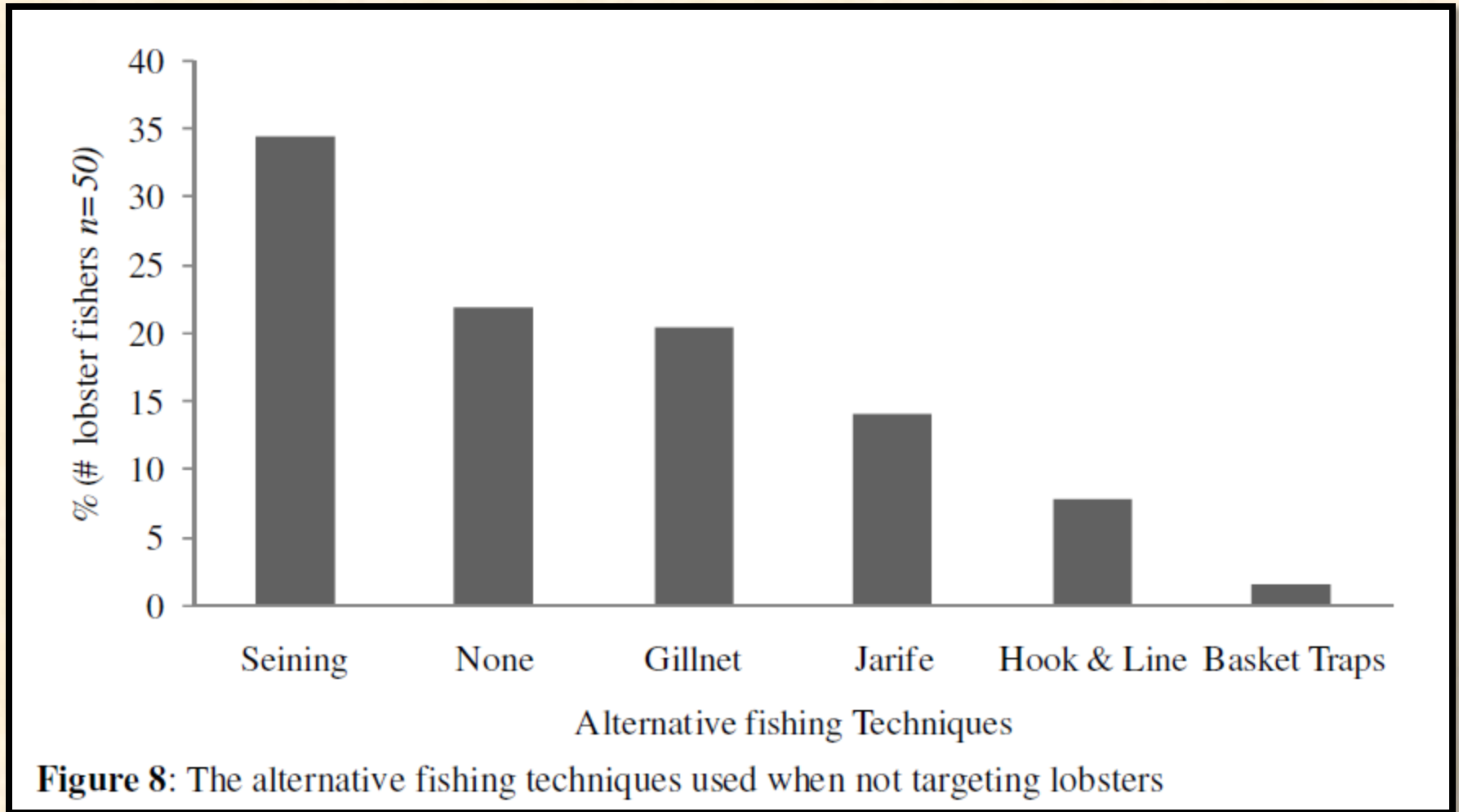
Sharing Fishing Grounds

Table 3: Overlap of fishing areas between landing site or villages.

Landing site	Fish community <i>imbos</i> only? <i>n</i> =50		
	No (%)	Yes (%)	n
Kiunga	27.8	72.2	18
Kiwayu	30.0	70.0	10
Kizingitini	100	0	22
Overall	60	40	50

- ❑ Fishers share *imbos* between villages
- ❑ Kizingitini frequently fish in other villages
- ❑ Kiunga & Kiwayu fishers mainly fish within

Alternatives Fishing Techniques used when not Fishing Lobsters



- Beach seining and Gillnet the most preferred alternatives

Lobster Market

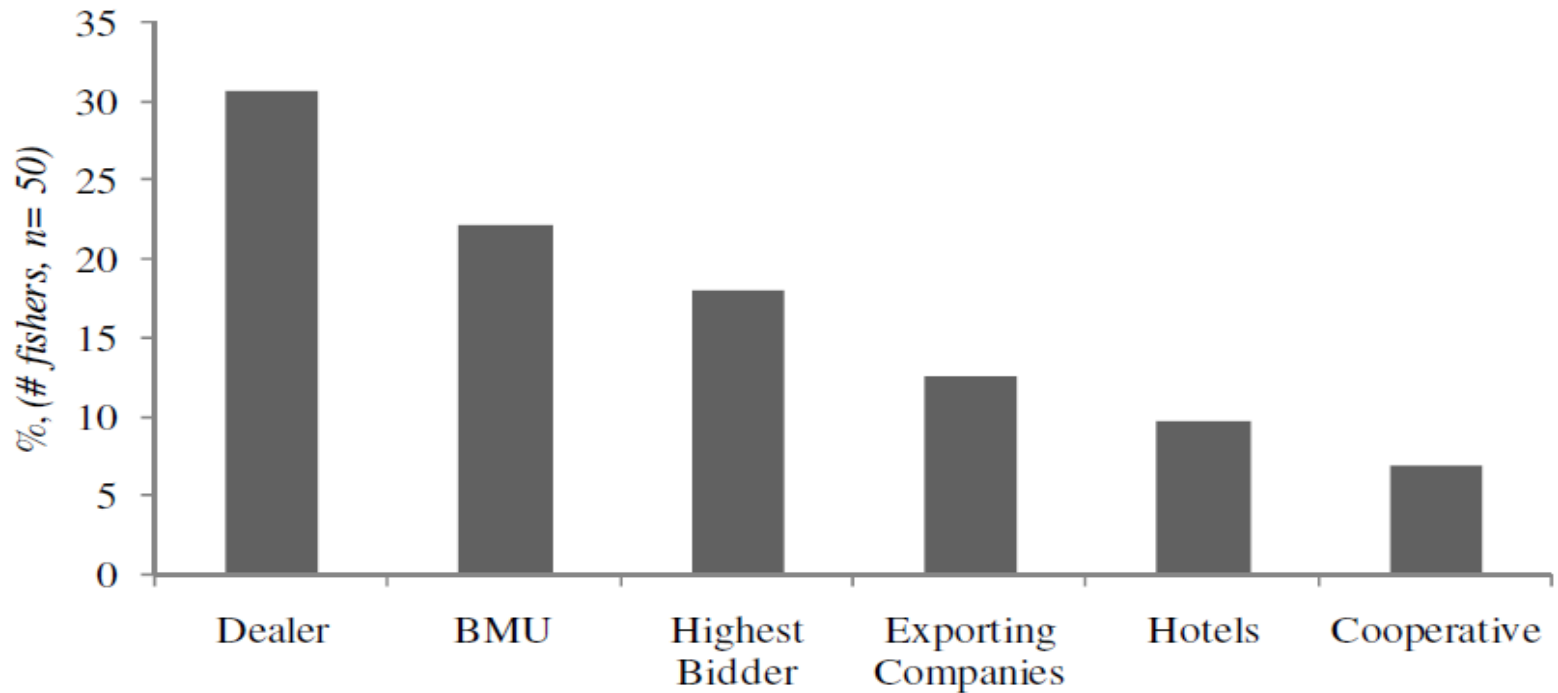


Figure 4: Fishers preferences of lobster market

- Lobsters sold without sorting by species
- P. ornatus* (mwani) most preferred
- Fishers would prefer to sell to dealers and BMUs

Preferred Lobster Management Options

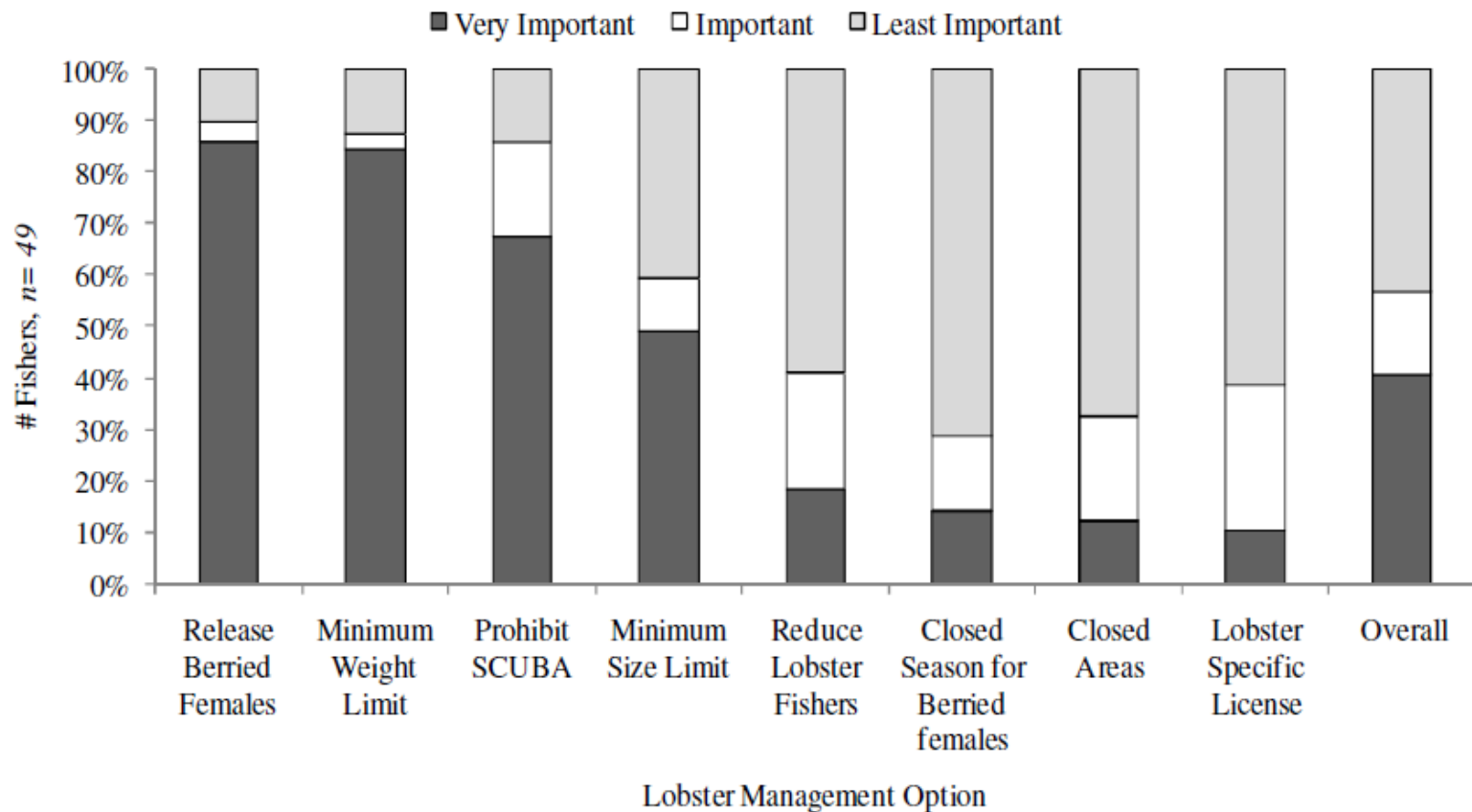


Figure 6: Fishers preferences on different lobster management options, $n=49$. One fisher did not answer the question.

- ❑ Release of berried females, MWL preferred most
- ❑ 56% of fishers would support some form of lobster management

Summary

- ❑ Results indicate lobster Stock not overfished
- ❑ YPR_{MSY} and target SSB are used as management reference points, YPR_{msy} is achieved when F is between 0.91-1.01
- ❑ To maintain 30% of the initial SSB, maximum SSB is achieved at $F=0.66-0.70$. Thus SSB is a more precautionary reference point than MSY.
- ❑ 300g MWL widely recommended to protect spawning stock & meet MSC certification & export market requirements. This weight corresponds to 70.0 mm CL minimum capture size, L_c .

Summary

- ❑ Closed season will be more precautionary
- ❑ Catches declined

Issues and Challenges

- ❑ Poor Access to Markets
- ❑ Unreliable prices
- ❑ Lack of storage facilities
- ❑ Lack of proper fishing gears and vessels
- ❑ Poverty
- ❑ Weak capacity of fisher institutions...BMUs and Cooperatives
- ❑ Low catches
- ❑ Unsustainable fishing
- ❑ Fishing of berried females and undersizes(<250g)

Acknowledgement

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Fishers

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